

**WHAT IS CLAIMED IS:**

1. A mobile radio communication apparatus applicable to a plurality of radio communication systems, comprising:

5 a wireless transmitter-receiver device configured  
to perform transmission/reception of a radio signal;

a signal processing device including a resource to which functions are defined, wherein the resource handles at least a modem function and a protocol function, and configured to perform a signal processing necessary in the transmission/reception by use of the resource; and

a controller which controls said signal processing device to redefine, to the resource, another modem function and another protocol function corresponding to respective one of the mobile communication systems.

2. A mobile radio communication apparatus according to claim 1, wherein said signal processing device comprises:

a general-use processor serving as a part of said resource and configured to carry out a part of said signal processing by executing a given program; and

a signal processing unit serving as another part of said resource and configured to carry out another part of said signal processing; and

said general-use processor comprises a register array configured to retain data directly

transmitted/received between the general-use processor itself and the signal processing unit.

3. A mobile radio communication apparatus according to claim 1, wherein said signal processing device comprises:

at least one programmable hardware device serving as a part of said resource and including a circuit structure capable of being redefined according to a set of a plurality of logic circuits which carry out basic calculations of at least a part of said signal processing; and

10 a general-use processor serving as another part of said resource and configured to carry out at least another part of said signal processing by executing a predetermined program; and

15 said controller determines respective shares of processing to be executed by said programmable hardware device and the general-use processor in accordance with the contents of said signal processing and controls said signal processing device to define, to the resource, the signal processing functions in accordance with determination of the share.

- 20 4. A mobile radio communication apparatus according to claim 1, wherein said signal processing device comprises:

25 at least one programmable hardware device serving as at least a part of said resource and including

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a circuit structure capable of being redefined according to a set of a plurality of logic circuits which carry out basic calculations of at least a part of said signal processing;

5        a first memory which stores a program indicating a procedure of said signal processing;

            a second memory which stores a plurality of circuit structure descriptions of said programmable hardware device corresponding to processing contents 10 respectively, the circuit structure descriptions being used for said signal processing device to carry out said signal processing; and

            a program sequencer configured to control the programmable hardware device and said second memory to 15 revise the circuit structure descriptions of said programmable hardware device in accordance with the program read out from said first memory under a control of said controller.

5. A mobile radio communication apparatus  
20 according to claim 4, wherein said signal processing device further comprises a general-use processor serving as another part of said resource and configured to carry out at least another part of said signal processing by executing a given program; and said 25 program sequencer determines respective shares of processing to be executed by said programmable hardware device and the general-use processor in accordance with

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the program read out from said first memory , selects  
one of said plurality of circuit structure descriptions  
stored in said second memory in accordance with  
determination of the shares and supplies selected  
5 description to said programmable hardware device, and  
gives an execution instruction of the processing to be  
shared by said general-use processor to said general-  
use processor.

6. A mobile radio communication apparatus  
10 applicable to a plurality of radio communication  
systems, comprising:

a wireless transmitter-receiver device configured  
to perform transmission/reception of a radio signal;

15 a signal processing device including a resource to  
which signal functions are defined, and configured to  
perform a signal processing necessary in the  
transmission/reception by use of the resource; and

20 a controller which controls said signal processing  
device to redefine, to the resource, a newly required  
signal processing function in accordance with a  
resource amount necessary for redefining the newly  
required signal processing function of the resource and  
a residual resource amount.

7. A mobile radio communication apparatus  
25 according to claim 6, wherein said controller acquires  
structure description information indicating a  
structure of said newly requested signal processing

function provided from an outside of said radio communication apparatus, and controls said signal processing device to define, to the resource, the newly required signal processing function in accordance with  
5 a resource amount necessary for defining the newly required signal processing function of the resource and an excessive residual resource amount, with use of the acquired structure description information.

10 8. A mobile radio communication apparatus according to claim 6, wherein

15 (a) said controller acquires structure description information provided from outside of said radio communication apparatus via said wireless transmitter-receiver device, the structure description information indicating a structure of said newly requested signal processing function;

20 (b) said controller obtains a resource amount necessary for defining, to the resource, the newly required signal processing function of the resource with use of the acquired structure description information;

25 (c) said controller compares said resource amount obtained and an initial resource amount preset in said signal processing device with each other;

(d) said controller grasps said excessive source amount when the obtained resource amount is smaller than the initial resource amount;

(e) said controller determines if it is possible to additionally define said newly requested signal processing function to said resource by comparing the grasped excessive resource amount with the resource amount necessary for defining, to the resource, the newly required signal processing function of the resource; and

(f) said controller executes an additional definition when it is determined that the additional definition can be done.

9. A wireless system comprising:  
the mobile radio communication apparatus according  
to claim 7; and

15 an information providing apparatus configured to  
provide the structure description information to said  
controller of said mobile radio communication  
apparatus.

20 10. A wireless system according to claim 9,  
characterized in that said information providing  
apparatus is installed in a base station which carries  
out radio communications with said mobile radio  
communication apparatus.

11. A wireless system according to claim 9,  
wherein said wireless transmitter-receiver device is  
25 configured to perform transmission/reception of a radio  
signal with said information providing apparatus; and  
said information providing apparatus comprises:

an another wireless transmitter-receiver device configured to perform transmission/reception of a radio signal with said mobile radio communication apparatus; and

5           an another controller configured to control said another wireless transmitter-receiver device to provide the controller with information for defining, to the resource, the newly required signal processing function in accordance with the resource amount and the excessive residual resource amount, the resource amount and excessive residual resource amount being grasped based on information acquired by the another controller and containing a use status of said resource.

10           12. A mobile radio communication apparatus applicable to a plurality of radio communication systems, comprising:

15           a wireless transmitter-receiver device configured to perform transmission/reception of a radio signal;

20           a signal processing device including a resource capable of redefining a signal processing function based on a predetermined software module, and configured to perform a signal processing necessary in the transmission/reception by use of the resource; and

25           a storage device configured to store a plurality of software modules respectively corresponding to said plurality of radio communication systems; and

              a controller which reads out at least one software

module corresponding to one of the mobile communication systems which is used by said mobile radio communication apparatus from said storage device , and controls said signal processing device and said storage device to supply the read-out software module to the resource.

13. A mobile radio communication apparatus according to claim 12, wherein said storage device is configured further to store a plurality of software modules respectively corresponding to a plurality of communication systems of different types; and

10                 said controller is configured to read out at least one software module corresponding to a type of communication conducted by said mobile radio 15 communication apparatus from said storage device and to control said signal processing device and said storage device to assign the read-out software module to the resource.

14. A mobile radio communication apparatus according to claim 12, wherein said controller characterized by comprises:

20                 a resource manager configured to manage a timing for determining a rewriting order of the software modules in the resource, whether or not the software 25 modules should be rewritten, and a timing for rewriting; and

                   a rewrite processor configured to read out

a predetermined one of the software modules from said storage device based on an instruction from said resource manager and to assign the read-out module to the resource thereby rewriting the software modules in  
5 the resource.

15. A mobile radio communication apparatus according to claim 12, wherein said controller comprises:

10 a resource manager configured to manage a timing for determining a rewriting order of the software modules in the resource, whether or not the software modules should be rewritten, and a timing for rewriting;

15 a download buffer configured to buffer at least one software module downloaded from outside; and

20 a rewrite processor configured to read out at least one software module from at least one of said storage device and said download buffer based on an instruction from said resource manager and to assign the read-out module to the resource thereby rewriting the software modules in the resource.

25 16. A mobile radio communication apparatus applicable to a plurality of radio communication systems, comprising:

a wireless transmitter-receiver device configured to perform transmission/reception of a radio signal;  
a signal processing device including a resource

to which signal functions are defined based on  
a predetermined software module, and configured to  
perform a signal processing necessary in the  
transmission/reception by use of the resource;

5           a storage device configured to store a plurality  
of software modules respectively corresponding to  
a plurality of signal processing functions executed by  
said signal processing device, and a table which  
records at least a use log of each of said plurality of  
software modules; and

10           a controller which controls said signal processing  
device and said storage device to read out at least one  
software module corresponding to a signal processing  
function to be executed by said signal processing  
device from said storage device, to assign the read-out  
software module to said signal processing device, and  
to rewrite at least one of the software modules stored  
in said storage device with reference to the table.

15           17. A mobile radio communication apparatus  
according to claim 16, wherein said storage device  
stores a use frequency of each of said plurality of  
software modules in the table as a use log of each of  
the software modules; and

20           25        said controller controls said storage device to  
rewrite the software modules by deleting one software  
module with a minimum use frequency of said plurality  
of software modules stored in said storage device with

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reference to the table.

18. A mobile radio communication apparatus  
according to claim 16, wherein said storage device  
stores a latest use date and time of each of said  
5 plurality of software modules in the table as a use log  
of each of the software modules; and

said controller controls said storage device to  
rewrite the software modules by deleting one software  
module with an oldest use data and time of said  
10 plurality of software modules stored in said storage  
device with reference to the table.

19. A mobile radio communication apparatus  
according to claim 16, wherein said storage device  
stores a size of each of said plurality of software  
15 modules in the table as a use log of each of the  
software modules; and

said controller controls said storage device to  
rewrite the software modules by deleting one software  
module with a largest size of said plurality of  
20 software modules stored in said storage device with  
reference to the table.

20. A mobile radio communication apparatus  
according to claim 16, wherein said storage device  
stores a version of each of said plurality of software  
25 modules in the table as a use log of each of the  
software modules; and

said controller controls said storage device to

compare a version of at least one software module corresponding to a signal processing function to be executed by said signal processing device with the versions of the software modules stored in said storage  
5 device with reference to the table, and when the versions of these software modules are equal to each other, said controller reads the software modules from said storage device and assigns the read-out modules to said signal processing device.

10        21. A mobile radio communication apparatus according to claim 20, wherein said controller further comprises a download buffer configured to buffer at least one software module downloaded from outside, and controls said signal processing device to download at  
15 least one software module corresponding to a signal processing function to be executed by said signal processing device when the versions of these software modules are not equal to each other, to buffer it to said download buffer and assign the buffered module to said signal processing device.  
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22. A radio communication apparatus applicable to a plurality of radio communication systems, comprising:  
a wireless transmitter-receiver device configured to perform transmission/reception of a radio signal;  
25        a signal processing device including a resource to which signal functions are defined based on a predetermined software module, and configured to

perform a signal processing necessary in the transmission/reception by use of the resource;

5           a storage device configured to store a plurality of software modules respectively corresponding to a plurality of signal processing functions executable by said signal processing device in correspondence with the radio communication systems , a plurality of first data files each having a file format corresponding to unique application software prepared for each of the 10 radio communication systems, and a second data file having a common file format;

15           a first converter device configured to execute conversion of at least one of said plurality of first data files stored in said storage device into the second data file, and newly store the second data file in said storage device;

20           a second converter device configured to execute conversion of at least one of said plurality of second data files stored in said storage device into at least one first data file; and

25           a controller configured to control said signal processing device and said storage device to read out a software module corresponding to a predetermined one of the radio communication systems from said storage device and to assign the read-out software module to said signal processing device.

23. A mobile radio communication apparatus

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according to claim 22, wherein said controller includes  
a processor;

    said first converter device executes conversion as  
    said processor executes a first software for  
5     conversion; and

    said second converter device executes conversion  
    as said processor executes a second software for  
    conversion.

24. A mobile radio communication apparatus  
10 according to claim 22, wherein said second converter  
    device converts at least one of the second data files  
    stored in said storage device into a first data file  
    having a file format corresponding to unique  
    application software prepared for said predetermined  
15 one mobile communication system, when said controller  
    reads out the software module corresponding to said  
    predetermined one of the radio communication systems  
    from said storage device and assigns the read-out  
    software module to said signal processing device.

20     25. A mobile radio communication apparatus  
        according to claim 22, wherein said application  
        software includes a telephone directory management  
        software and said storage device stores a telephone  
        number file as the first and second data files.

25     26. A mobile radio communication apparatus  
        according to claim 22, wherein said application  
        software includes a browsing software for Web pages and

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said storage device stores a URL (uniform resource locators) file as the first and second data files.

27. A mobile radio communication apparatus according to claim 22, wherein said application  
5 software includes an e-mail software and said storage device stores an e-mail file as the first and second data files.

28. A mobile radio communication apparatus according to claim 22, wherein said application  
10 software includes an e-mail software and said storage device stores a mail address file as the first and second data files.